

Chinook winds through Alaska Range Passes

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Overview

Chinook winds are a common occurrence during the wintertime of Alaska. They are often feared by snow enthusiasts, yet desired by those whom need a break from the severe wintertime cold. In the Fairbanks forecast office, Chinooks are fairly common through the Alaska Range area in east-central Alaska, highlighted in red below (Figure 1). A Chinook, originally defined in meteorology as a warming wind from the ocean into the interior regions of the Pacific Northwest, is defined in the Fairbanks CWA very similarly. Strong south winds are projected over the Alaska Range mountains, and block moisture in areas due north of the mountain range while warming up the leeward side of the mountains due to adiabatic heating.

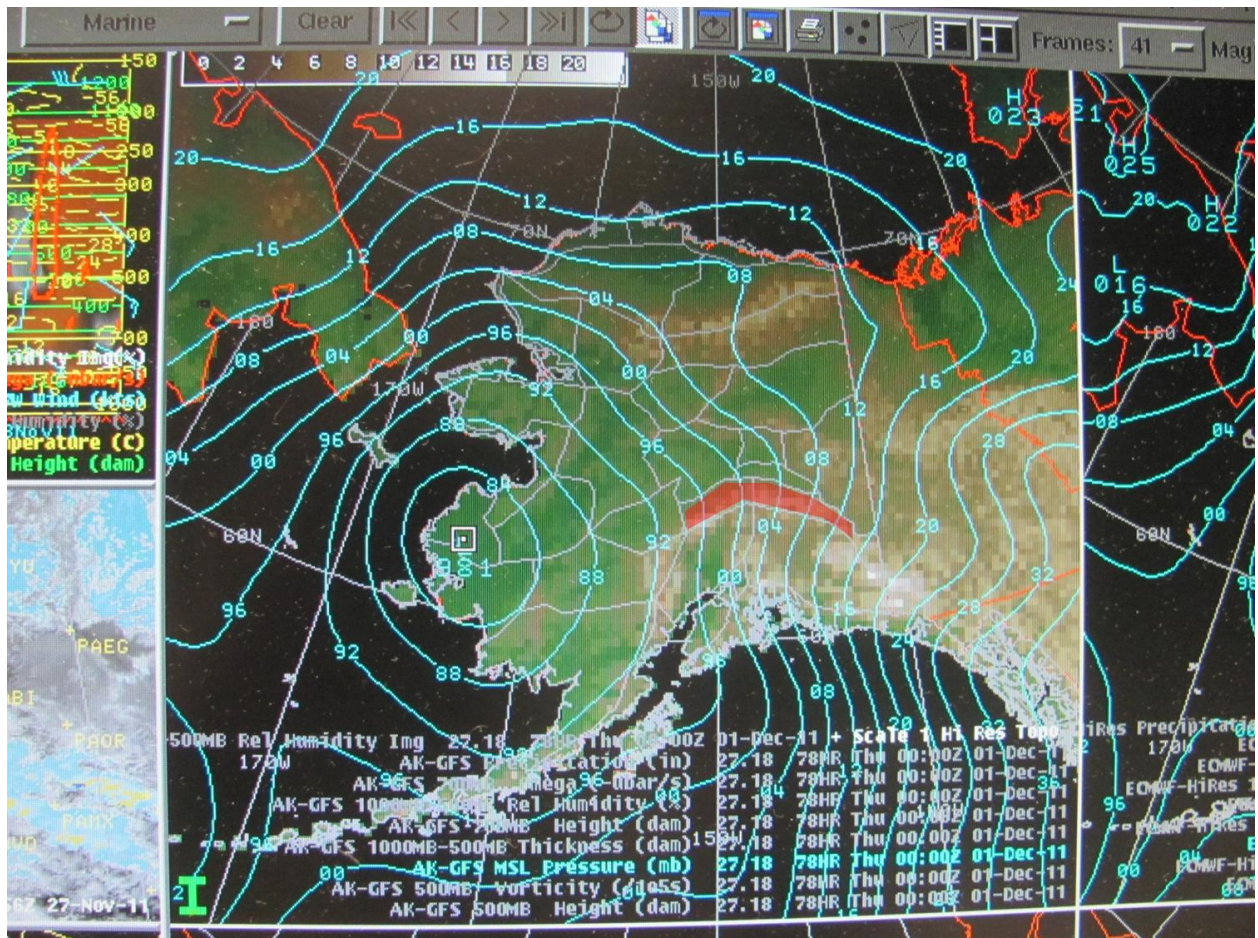


Figure 1: MSL Pressure from the AK-GFS model at 78 hours - 0000UTC Thu Dec 1,2011

Synoptic Conditions

The synoptic pattern needed for Chinook winds include a surface low pressure system in western Alaska (Figure 2). The stronger the low pressure, the tighter the gradient through the mountain passes, which correlates to higher winds.

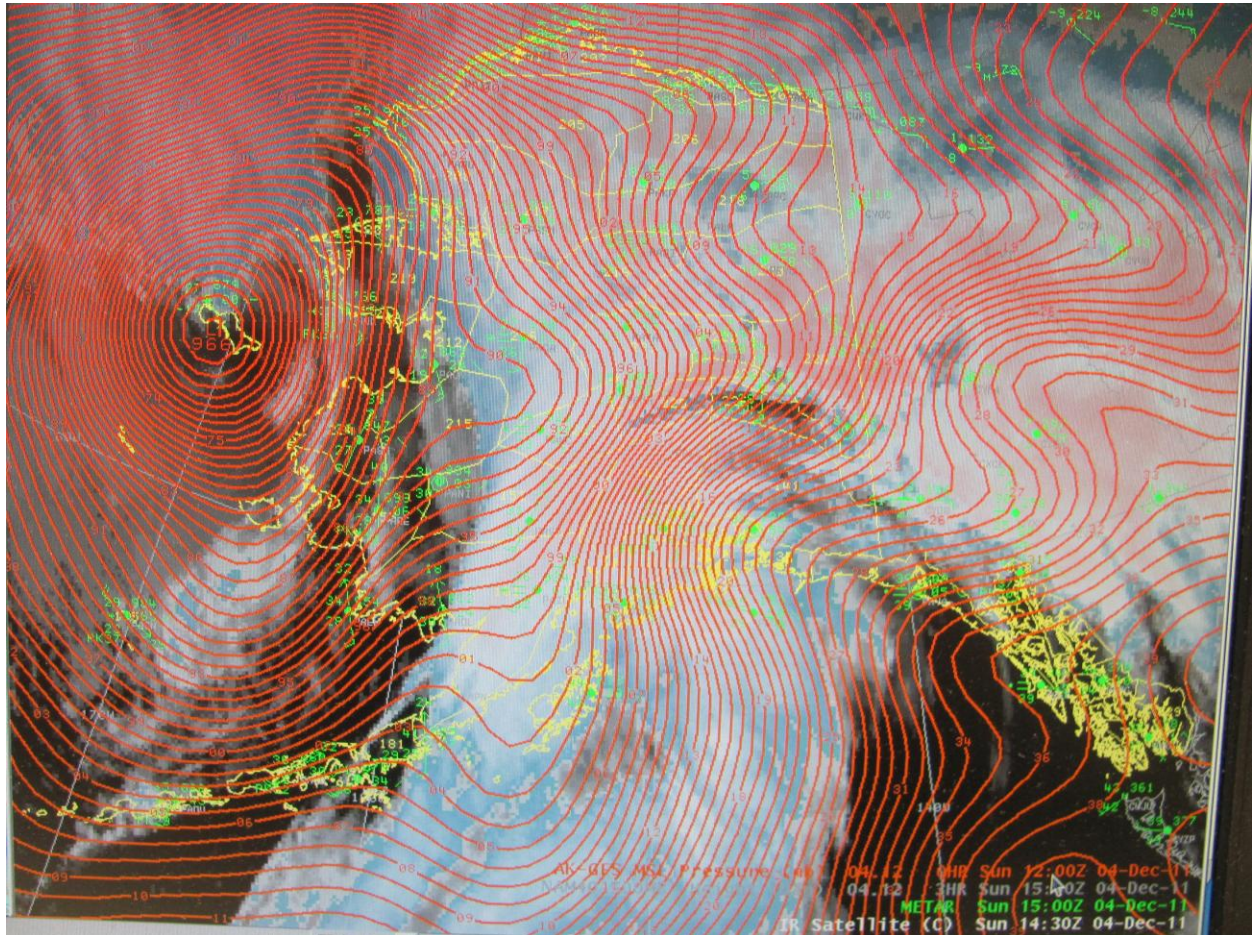


Figure 2: Satellite image with MSL Pressure during Chinook event at 1430UTC on December 4, 2011.

An anomalously windy station in the Fairbanks CWA, Antler Creek (ACRA2), is situated just north of Denali National Park in the western Alaska Range at 1844 feet above sea level¹. Near the Antler Creek weather station is a narrow north to south channel along the Parks Highway (Interstate A-4), which cuts through the mountains, and serves as a Chinook dispenser for this area. Figure 3 shows winds from a Chinook event in December of 2011. Take a look at the “Parks Highway @” station highlighted in red, which are the readings from the AWIS station at Antler Creek, 1844 ft above sea level.

¹ There is a discrepancy on ACRA2’s elevation on ROMAN which claims Antler Creek is at 1516 ft

AK225: Denali																	
Station	Elev	Time		Current					24 Hour					Precipitation			
		LOCAL	UTC	TEMP	RH	WIND	DRCT	PKWIND	MAX T	MIN T	MAX RH	MIN RH	MAX G	1 HR	3 HR	6 HR	24 HR
DENALI VISITOR C	1650 ft	0727AKS	1627	43	60	12	SSE	29	43	21	93	59	31	0.07	0.30	0.57	0.57
EIELSON VISTOR C	3653 ft	0733AKS	1633	40	66	9	E	16	42	27	66	48	47	0	0	0	0
KANTISHNA	1550 ft	0600AKS	1500	50	-	-	-	-	51	12	-	-	-	1.00	1.00	0	0
McKinley Park, M	1719 ft	0756AKS	1656	43	65	14	SSW	23	45	25	100	57	37	-	-	-	-
Parks Highway @	1516 ft	0700AKS	1600	44	54	48	SSE	66	44	30	95	43	81	-	-	-	-
STAMPEDE	1800 ft	0734AKS	1634	47	52	7	SSE	10	47	9	89	47	17	0.02	0	0.08	0.08
TOKLAT	2920 ft	0733AKS	1633	41	68	15	SE	23	41	2	90	31	38	0	0	0	0
WONDER LAKE	2050 ft	0727AKS	1627	47	47	27	SSE	41	50	27	71	42	45	0	0	0	0.18
AK226: Eastern Alaska Range																	
Station	Elev	Time		Current					24 Hour					Precipitation			
		LOCAL	UTC	TEMP	RH	WIND	DRCT	PKWIND	MAX T	MIN T	MAX RH	MIN RH	MAX G	1 HR	3 HR	6 HR	24 HR
Alaska Highway @	1473 ft	0710AKS	1610	28	79	4	E	7	29	15	90	78	18	-	-	-	0
BOLIO	1631 ft	0724AKS	1624	32	0	0	N	0	32	32	0	0	0	0	0	0	0
Bolio	1388 ft	0715AKS	1615	47	51	23	SSE	48	47	18	85	47	63	0	0	0	0
CHICKEN CREEK	5240 ft	0733AKS	1633	35	65	12	SSE	19	37	13	93	61	28	0	0	0	0
CHISANA	3318 ft	0657AKS	1557	33	89	3	E	6	37	2	99	73	13	0	0	0	0
CHISANA	3320 ft	0600AKS	1500	40	-	-	-	-	40	8	-	-	-	1.80	1.80	0.40	0.40
DONNELLY	1360 ft	0724AKS	1624	32	0	0	N	0	32	32	0	0	0	0	0	0	0
GOLD KING	1700 ft	0711AKS	1611	52	38	6	WNW	16	52	22	71	38	32	0.01	0.04	0.22	0.93
OP12	1598 ft	0730AKS	1630	44	62	31	SSW	58	44	14	98	60	65	-	-	-	-
Richardson Hwy @	2477 ft	0703AKS	1603	42	62	24	SE	38	43	17	95	58	47	-	-	-	0.78
TOK RIVER VALLEY	2300 ft	0753AKS	1653	24	98	0	NNE	13	26	3	98	90	13	0	0	0	0
Texas Condo	1936 ft	0615AKS	1515	43	59	34	SSW	63	44	18	80	55	63	0	0	-	0
Texas Range	1601 ft	0715AKS	1615	45	55	18	S	42	45	17	84	50	55	0	0	0	-
Tok Cutoff @ Men	2402 ft	2122AKS	622	25	83	0	N	0	25	8	92	83	0	-	-	-	-

Figure 3: Winds from 1630 UTC on Dec 4, 2011

The winds at Antler Creek are 2 to 4 times higher than the winds at nearby surrounding area weather stations, such as McKinley Park, Denali Visitor Center, and Stampede.

As one can see under zone 226, the eastern Alaska Range is also affected by the Chinook winds. The eastern Alaska range has more than one type of local wind due, because this zone is also affected by the Tanana Valley Jet (see microclimate write up for event).

Impact on forecasts

Local wind effects include not only high winds for aviation and travel, but have an immediate impact on temperature forecasts and precipitation shadowing. The GFS and NAM models do fairly well in identifying Chinook events, but there are events every winter which are missed 24 hours ahead of time. This is due to the weather models predicting a more westerly flow at 700mb, rather than a southerly flow which is needed for an Alaska Range Chinook event. In forecasted westerly wind events, the forecaster should be aware of any weather front or short-wave troughs moving along in the flow which

may turn the winds more southerly than what the models indicate. A 30 degree difference in winds can create a 40 degree temperature difference in the north slopes of the Alaska Range, as well as a major missed snow event or a non-snow event.

A +30kt south (Chinook) wind at 700mb through the Alaska Range will create a substantial warm up in interior Alaska during mid-winter. Though this is not the only way in which interior Alaska temperatures can warm during the winter, it is the most common way for a substantial warm-up during the season when there is a negative net radiation balance.

Chinook Wind versus Gap Flow

A common misunderstanding is the difference between a Chinook wind event and a Gap flow event through the Alaska Range. To distinguish a Chinook wind event from Gap flow, the forecaster needs to look at a surface analysis as well as the atmosphere aloft (Figure 4). A typical Gap flow event is characterized by a surface trough developing north of the Alaska Range and a surface ridge developing south of the Alaska Range, funneling the wind through the mountains from high to low pressure. Gap flow does not have support aloft, like Chinook winds do; therefore, Gap winds will only affect the passes of Alaska Range, and will not warm up interior Alaska like Chinook wind events do. A Chinook is an event defined at levels aloft (700mb), present down to the surface. A Chinook filters down to the surface due to compressional warming, affecting a much larger area. During a Chinook event, the Alaska Range and the south-central interior of Alaska, including the city of Fairbanks, will warm up.

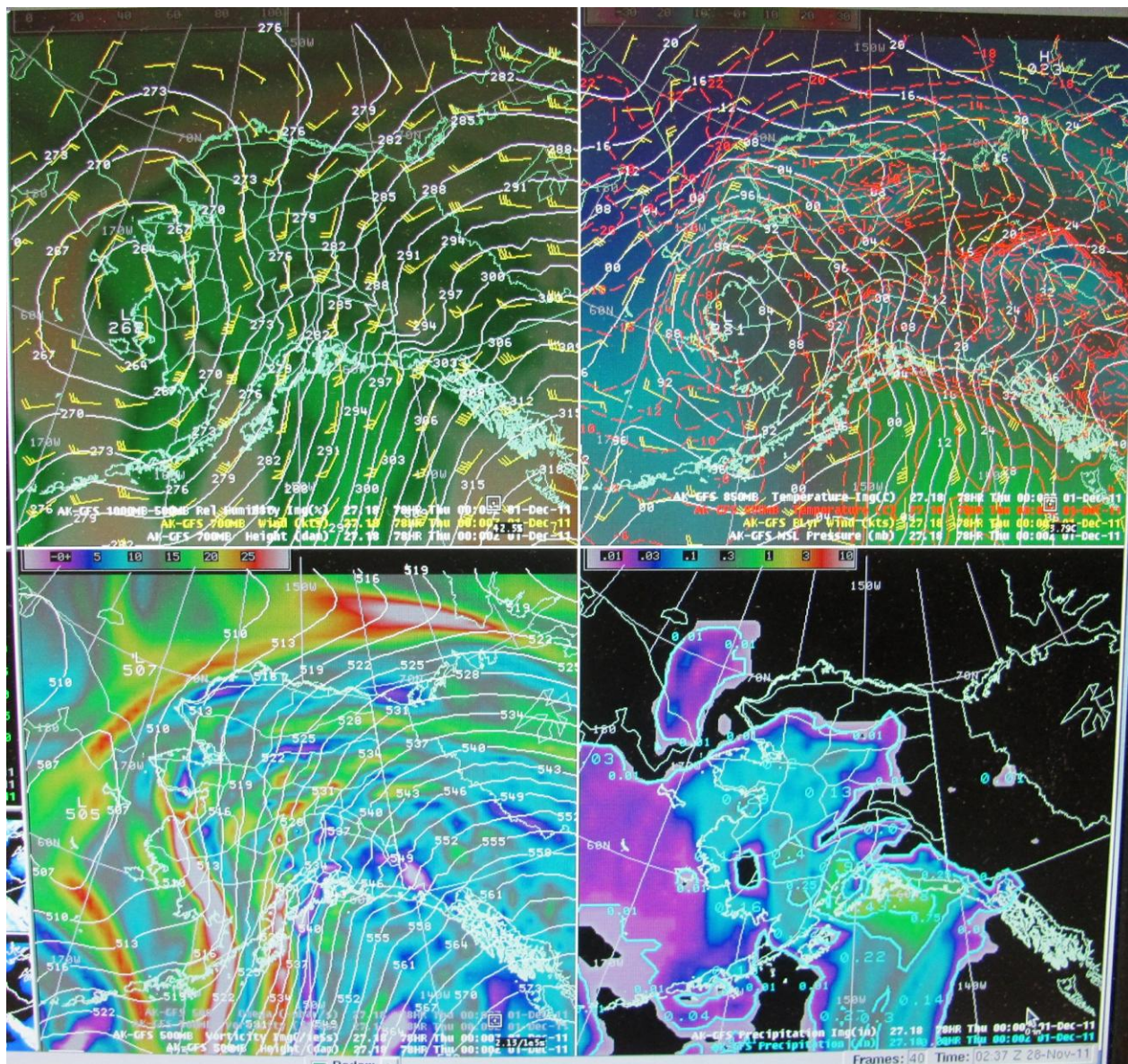


Figure 4: Four-panel GFS forecast for Chinook event at 0000UTC December 1, 2011. Note the upper left 700mb south wind and isobars, as well as the upper right panel surface isobars.

Acknowledgments: Thanks to John Lingaas and Rick Thoman at WFO Fairbanks for providing their insights on Chinook and Gap flow winds.